CLAIMS

1. A surgical instrument for insertion into a body, the surgical instrument comprising:

an elongated member comprising a distal portion adapted to engage tissue in the body and a proximal portion capable of being manipulated by a user, wherein said elongated member can be moved by said user in a degree of freedom;

a sensor positioned to detect position or motion of the elongated member, or a portion thereof, in said degree of freedom of the elongated member;

an actuator engageable with the elongated member to apply a force thereto; and

a controller in communication with the sensor and the actuator, the controller adapted to control the application of the force, wherein the force is applied to the elongated member as a haptic indication to the user when the elongated member has been moved a predetermined distance or to a predetermined position by the user in the degree of freedom.

2. A surgical instrument according to claim 1 wherein the degree of freedom is a translational degree of freedom.

3. A surgical instrument according to claim 1 wherein the degree of freedom is a rotational degree of freedom.

4. A surgical instrument according to claim 1 wherein the haptic indication includes at least one of a detent force, a vibration, a barrier force, a damping force, and a spring force.

5. A surgical instrument according to claim 1 wherein the haptic indication is output to the user when the distal portion of the elongated member has been translated to an end of a working channel that guides said elongated member.

6. A surgical instrument according to claim 1 wherein said haptic indication is output to the user each time the elongated member additionally moves the predetermined distance.

7. A surgical instrument according to claim 1 wherein the elongated member includes one or more of a guidewire, a catheter, a heart pacing lead, and a stylet.

8. A surgical instrument according to claim 1 wherein the distal portion of the elongated member includes one or more of a blade, a serrated edge, a biopsy tool, a trocar tip, an ultrasonic tool, a needle, a vibrating tip, a suturing tool, a retractor, an electrosurgical cutter, an electrosurgical coagulator, a forceps, a needle holder, scissors, an irrigator, an aspirator, a medicator, a laser tool, a cryogenic tool, a flexible steering or guiding tip, and a camera.

9. A surgical instrument for insertion into a body, the surgical instrument comprising:

an elongated member comprising a distal portion adapted to engage tissue in the body and a proximal portion capable of being manipulated by a user in a degree of freedom;

a sensor positioned to detect a first force applied to the elongated member by the user in the degree of freedom;

an actuator engageable with the elongated member to apply a second force thereto in the degree of freedom; and

a controller in communication with the sensor and the actuator, the controller adapted to control the application of the second force in relation to the first force detected by the sensor.

10. A surgical instrument according to claim 9 wherein the degree of freedom is translational.

11. A surgical instrument according to claim 9 wherein the degree of freedom is rotational.

12. A surgical instrument according to claim 9 wherein the controller is programmable.

13. A surgical instrument according to claim 10 wherein the magnitude of the second force is from about 10 percent to about 90 percent of the first force detected by the sensor.

14. A surgical instrument according to claim 13 wherein the second force is applied in a direction opposing insertion of the elongated member.

15. A surgical instrument according to claim 10 further comprising an outer member comprising an orifice into which the elongated member is insertable and wherein the actuator is housed within the orifice.

16. A surgical instrument according to claim 15 wherein the outer member is an endoscope and wherein the orifice is a working channel of the endoscope.

17. A surgical instrument according to claim 15 wherein the outer member is an introducer sheath and wherein the elongated member is an endovascular instrument.

18. A surgical instrument according to claim 17 wherein the endovascular instrument comprises one or more of a guidewire, a catheter, a heart pacing lead, and a stylet.

19. A surgical instrument according to claim 10 wherein the actuator is capable of applying the second force so that the second force is additive to the first force applied to the elongated member by the user.

20. A surgical instrument according to claim 9 wherein the actuator is capable of applying the second force so that the second force reduces the first force applied to the elongated member by the user.

21. A surgical instrument according to claim 9 further comprising a sensor coupled to the actuator to detect the second force.

22. A surgical instrument according to claim 10 further comprising a position detector coupled to the elongated member to detect a relative insertion position of the elongated member.

23. A surgical instrument according to claim 9 wherein the distal portion comprises one or more of a blade, a serrated edge, a biopsy tool, a trocar tip, an ultrasonic tool, a needle, a vibrating tip, a suturing tool, a retractor, an electrosurgical cutter, an electrosurgical coagulator, a forceps, a needle holder, scissors, an irrigator, an aspirator, a medicator, a laser tool, a cryogenic tool, a flexible steering or guiding tip, and a camera.

24. A surgical instrument according claim 10 further comprising a sensor positioned to detect a rotational force being applied to the elongated member by the user and a second actuator engageable with the elongated member to apply a rotational force thereto.

25. A surgical instrument according to claim 11 wherein the second force is a rotational force.

26. An endoscopic assembly comprising:

an endoscope comprising an orifice;

an actuator within the orifice;

an elongated member insertable into the orifice; and

a sensor positioned to detect a force being applied to the elongated member.

27. An endoscopic assembly according to claim 26 further comprising a controller in communication with the actuator and the sensor.

28. An endoscopic assembly according to claim 27 wherein the actuator is adapted to apply a force to the elongated member and wherein the controller is adapted to control the force applied to the elongated member in relation to the force detected by the sensor.

29. An endoscopic assembly according to claim 27 wherein the controller is at least partially within the orifice.

30. An endoscopic assembly according to claim 26 wherein the sensor is positioned to detect a longitudinally directed force applied to the elongated member by a user.

31. A method of inserting a surgical instrument into an insertion site in or on a body, the method comprising:

inserting the surgical instrument into an orifice;

applying a user force to a portion of the surgical instrument to force the instrument in an insertion direction; and

applying a second force to the instrument from within the orifice.

32. A method according to claim 31 further comprising sensing the user force.

33. A method according to claim 32 wherein the second force is related to the user force.

34. A method according to claim 31 wherein the second force is in the insertion direction.

35. A method according to claim 31 wherein the second force is in a direction opposite to the insertion direction.

36. A method according to claim 31 wherein the second force is applied by an electromechanical actuator.

37. A method according to claim 31 further comprising:

detecting a position of the surgical instrument in a working channel extending from the orifice, the surgical instrument being sensed in the working channel using a sensor device, wherein the second force is applied to a portion of the surgical instrument using an actuator to move the instrument through the working channel, wherein the surgical instrument is moved to a position so that a leading end of the surgical instrument is located at a predetermined distance relative to an end of the working channel.